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Section 2

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2. Environmental Setting

2.1 General

This section provides a general overview of the environmental setting for the Rest of River area of the Housatonic River. Information previously presented in the 1996 RFI Report (BBL, 1996) is updated in this report with more recent data, where available.

Section 2.2 briefly describes the physical location and extent of the Rest of River area, including a description of the Rest of River channel itself, backwater areas, dams and impoundments, and floodplain areas. Section 2.3 provides a discussion of regional climatic conditions, and Sections 2.4 and 2.5 briefly describe the hydrology and hydrogeology, respectively, related to the Rest of River. Finally, the primary constituents in the Rest of River evaluated in this RFI Report are discussed in Section 2.6.

2.2 Location and Extent of Site

2.2.1 General

The headwaters of the Housatonic River are located in the Berkshire Mountains of western Massachusetts. The River is formed by the confluence of the East and West Branches (Confluence), which converge in the City of Pittsfield. The East Branch flows past GE's facility, approximately two miles above the Confluence. Below the Confluence, the River generally flows south through Berkshire County for approximately 10 miles to Woods Pond, the first significant impoundment. Downstream of Woods Pond, the River continues south/southeast through western Massachusetts and south/southeast through Connecticut before emptying into Long Island Sound at Stratford, Connecticut (Figures 1-1, 2-1, 2-2, and 2-3), a total of 135 miles.

The total watershed of the Housatonic River and its tributaries covers 1,950 square miles -- 500 in Massachusetts, 218 in New York, and 1,232 in Connecticut (Lawler, Matusky & Skelly [LMS], 1985). Figure 1-1 illustrates the watershed of the Housatonic River Basin in Massachusetts, New York, and

Connecticut. Housatonic River Basin elevations range from sea level at the mouth of the River to over 2,600 feet, based on National Geodetic Vertical Datum (NGVD) 1929 at Brodie Mountain, Massachusetts, in the northwest portion of the basin. The topography of the Housatonic River Basin in western Massachusetts is characterized by rough, glaciated terrain. The area contains highlands to the east, the Taconic Range to the west, and the main valley of the Housatonic River and its tributaries in the central portion of the basin (Norvitch et al., 1968). The topography of the basin in northwestern Connecticut is comparable to that in western Massachusetts. The region consists of hills and ridges aligned in a north-south orientation, with locally rugged areas along the major watercourses (Wilson et al., 1974). However, the extreme southern portion of the basin in Connecticut is characterized by flatlands of the Atlantic coastal plain.

The drainage area distribution represents an important feature of the system, as it largely controls the Housatonic River's hydrologic response to precipitation intercepted by the watershed. The drainage area upstream of the USGS gage at Great Barrington is approximately 282 square miles (mi^2). This area was delineated into 41 subwatersheds (Figure 2-4) based on main stem and majority tributary networks, topography, USGS gage station locations, and GE and EPA monitoring locations using watershed delineation tools in EPA's Basins software. These subwatersheds range in size from less than 1 to 24 mi^2. The drainage area upstream of the Confluence is 130 mi^2, which is 46% of the watershed upstream of Great Barrington. Drainage areas of the East and West Branches are similar in size (69 mi^2 and 61 mi^2, respectively). At Woods Pond Dam, the drainage area increases to 169 mi^2 and accounts for 60% of the drainage area upstream of Great Barrington. The Housatonic River watershed topography upstream of Great Barrington is shown on Figure 2-5.

For purposes of evaluating data collected from the Rest of River portion of the Housatonic River, the River reach designations established in the SI Work Plan (Weston, 2000) have been incorporated throughout this RFI Report. The reaches are:

- Reach 5, from the Confluence downstream to the headwaters of Woods Pond (the first significant impoundment);
- Reach 6, Woods Pond;
- Reach 7, Woods Pond Dam to Rising Pond (the next significant impoundment);
- Reach 8, Rising Pond;

- Reach 9, Rising Pond Dam to the Connecticut border; and
- Connecticut portion of the River.

Several landmarks, river mile (RM) points, and associated River reaches are shown in Table 2-1. Reach locations are also shown on Figures 2-1, 2-2, and 2-3. The RM index presented below uses the River mouth on Long Island Sound (RM 0.0) as a reference and provides a convenient means of locating various points of interest along the River.

Table 2-1. River Mile Locations of Landmarks

Landmark	River Mile	EPA River Reach[1]
Coltsville USGS Gaging Station	140.6	Reach 1
Confluence of East and West Branches	135.1	Reach 5
Holmes Road Bridge	134.1	
Pittsfield Wastewater Treatment Plant (WWTP)	130.1	
New Lenox Road Bridge	129.2	
Roaring Brook	128.0	
Woods Pond Headwaters	125.4	
Woods Pond	124.8	Reach 6
Woods Pond Footbridge	124.6	
Woods Pond Dam	124.4	
Schweitzer Bridge	124.2	Reach 7
Columbia Mill Dam	122.1	
Willow Mill Dam	115.6	
Glendale Dam	109.0	
Rising Pond Headwaters	106.0	
Rising Pond	105.5	Reach 8
Rising Pond Dam	105.2	
Great Barrington USGS Gaging Station	104.2	Reach 9
MA/CT Border	81.2	
Falls Village Dam	74.0	--
Bulls Bridge Dam	53.2	

Note:
1. From SI Work Plan (Weston, 2000).

The primary focus of this RFI Report is the reach of the River between the Confluence near Pittsfield (RM 135.1) and Woods Pond Dam (RM 124.4). The portion of the River from the Confluence to the Headwaters of Woods Pond (Reach 5) was further divided into three subreaches: 5A, 5B, and 5C (Figure 2-3). Reach 5A is approximately 5 miles long and extends from the Confluence at RM 135.1 to the Pittsfield WWTP (RM 130.1). The second reach (5B) is about 2 miles long and defined as the region from the Pittsfield WWTP to Roaring Brook (RM 128.0). Reach 5C extends 3 miles from Roaring Brook to the Woods Pond Headwaters at RM 125.4. The Woods Pond reach (Reach 6) extends from the headwaters to the dam, a distance of 1 mile.

Between the Confluence and Woods Pond Dam, the River floodplain, defined generally by the 1 mg/kg PCB isopleth (see Figure 2-1), varies in width from approximately 100 feet to 3,700 feet and encompasses an area of approximately 750 acres. Backwaters are found in Reaches 5A, 5B, and 5C, with the number and size of backwaters generally increasing downstream from the Confluence. Within Reach 5, backwaters have a total area of approximately 125 acres, with about 60% of the total backwater area contained in Reach 5C. An additional 12 acres of backwater regions are located immediately adjacent to Woods Pond.

2.2.2 River Channel

From the Confluence, the Housatonic River flows southward through Pittsfield and the towns of Lenox and Lee in Berkshire County approximately 10 miles to the first significant impoundment, Woods Pond (which covers approximately 60 acres). The River continues flowing south from Woods Pond and, between Lee and South Lee, turns and flows westward through the town of Stockbridge to Glendale. The flow of the River is slightly impeded by the Columbia Mill Dam in Lenoxdale, the Willow Mill Dam in Lee, and the Glendale Dam in Glendale (see Figure 2-1 for locations). From Glendale, the River flows south through Risingdale, where the next significant impoundment downstream of Woods Pond, Rising Pond, is located. Rising Pond is located approximately 18 miles downstream of Woods Pond, measures approximately 40 acres in size, and is impounded by Rising Pond Dam. Below Rising Pond Dam, the River continues to flow southward through the towns of Great Barrington and Sheffield, along a widened, relatively flat floodplain that includes many meanders and oxbows.

The River enters the state of Connecticut near Ashley Falls, Massachusetts, approximately 1 mile north of Canaan, Connecticut. The River continues to flow generally south approximately 86 river miles through Litchfield, Fairfield, and New Haven counties, including Falls Village, West Cornwall, Bulls Bridge, Derby, and Stratford, to the Long Island Sound. Impoundments along this stretch of the River in Connecticut include those at Falls Village and Bulls Bridge, as well as Lakes Lillinonah, Zoar, and Housatonic (these impoundments are further discussed in Section 2.2.4).

A number of tributaries enter the Housatonic River as it flows generally southward for 135 river miles from the Confluence in Pittsfield, Massachusetts, to its mouth at Long Island Sound. In addition to the East and West Branches (which drain the headwaters), the main tributaries to the River in Massachusetts are Hop Brook, Williams River, Green River, and Konkapot River. In Connecticut, the main tributaries are the Ten Mile, Still, Shepaug, Pomperaug, and Naugatuck Rivers.

Three small tributaries discharge to the Housatonic River in Massachusetts between the Confluence and Woods Pond Dam: Sackett Brook (11 mi^2 watershed), Roaring Brook (8 mi^2 watershed), and Yokun Brook (6 mi^2 watershed) (Figure 2-3). Additionally, the Pittsfield WWTP contributes a significant amount of discharge during low to moderate flow conditions in the River. The River in this approximately 10-mile reach is generally characterized as a sinuous or meandering channel within a relatively wide, vegetated floodplain that contains backwaters, oxbows, and other features of a meandering stream (Figure 2-3).

The elevation of the Housatonic River at the Confluence in Pittsfield is approximately 960 feet NGVD. Elevations are approximately 950 and 680 feet NGVD at Woods Pond Dam and the USGS gage at Great Barrington, respectively. The elevation at the Massachusetts-Connecticut state line, approximately 54 river miles downstream from the Confluence, is about 650 feet NGVD. The Housatonic River continues approximately 81 river miles through the state of Connecticut where it enters Long Island Sound at sea level. Overall, the elevation of the Housatonic River decreases approximately 960 feet over a distance of 135 river miles from the Confluence in Pittsfield to the mouth of the River at the Long Island Sound.

2.2.2.1 Bathymetry and Geometry

The 11 miles of the Housatonic River between the Confluence and Woods Pond Dam (the area that is the primary focus of this RFI Report) contain four main geometric features: main channel, backwaters, floodplain, and Woods Pond. The River has a meandering channel between the Confluence (RM 135.1) and the headwaters of Woods Pond (RM 125.4; Figure 2-3). The River exhibits features typical of a meandering, sand-bed river: meanders of various sizes, oxbows, backwaters, and cutoffs. The occurrence of these physical features is spatially variable, with some portions of the River having a relatively high degree of meandering and other reaches being relatively straight channeled. Generally, the degree of meandering increases with distance downstream of the Confluence.

In 1999, EPA measured and quantified the channel cross-sectional geometry at approximately 200 locations between the Confluence and Woods Pond. Channel width varies from approximately 40 feet to 210 feet, with the width of the channel generally increasing between the Confluence and Woods Pond Headwaters (Figure 2-6). A useful geomorphologic measure is the ratio of channel width to bank-full water depth. Ratios greater than 12 generally correspond to meandering channels (Rosgen, 1996). The spatial distribution of the width:depth ratio is shown on Figure 2-7. Generally, this ratio is approximately 12 in many locations, with no clear trend observable in the data providing evidence that the River can be characterized as moderately meandering in this reach.

Detailed cross-section surveys were not performed downstream of Woods Pond Dam. However, CR Environmental, Inc. (CR), on behalf of EPA, performed a bathymetry survey in Rising Pond in December 1998. Water depths ranged from 1 foot to 15 feet, with the deeper locations following the former River channel (i.e., the course of the River prior to construction of the dam).

2.2.2.2 Water Depth

Water depth (bathymetry) varies both spatially and temporally, with depth increasing as flow rate in the River increases. To illustrate the spatial variability of water depth in the main channel of the River, water depth was estimated at bank-full discharge using EPA transect data (Figure 2-8). Water depths at the bank-full flow rate, which is approximately 1,100 cubic feet per second (cfs) at the Confluence, range from about 3 feet to 15 feet. Water depths in Woods Pond range from about 3 feet to 15 feet, with a relatively deep hole in the southeast portion of the pond (Figure 2-9). Backwaters are generally 3 feet to 5 feet deep. A relatively shallow sill (~1 to 2 feet deep) typically separates backwater areas from the main channel.

2.2.2.3 Gradient

Several factors influence the water surface elevation changes that result from flows in the Housatonic River. In addition to the more visible natural and manmade features of the River such as tributaries, oxbows, dams, bridges, piers, and bypasses, the channel slope also has a major effect upon the resulting water surface profile.

Along the entire Massachusetts portion of the Rest of River, reaches with three distinct channel gradients have been identified: from the Coltsville USGS gaging station on the East Branch (located upstream of the Confluence) to the Schweitzer/Lenoxdale Bridge (located just downstream of Woods Pond Dam); Schweitzer/Lenoxdale Bridge to the Great Barrington USGS gaging station; and Great Barrington to the Connecticut border (see Figures 1-1 and 2-1) (Stewart, 1982). From the Coltsville gaging station to the Schweitzer/Lenoxdale Bridge, the average channel gradient is approximately 4.2 feet per mile or less than $1x10^{-3}$; the gradient between the Schweitzer/ Lenoxdale Bridge and the Great Barrington gaging station is 12 feet per mile or 2×10^{-3}; and from Great Barrington to the Connecticut border, the channel gradient lessens to approximately 2 feet per mile or 4×10^{-4} (Stewart, 1982). Between the Connecticut border and the Long Island Sound, the River decreases approximately 650 feet over 81.2 miles, which equates to an average gradient of 8 feet per mile or 1.5×10^{-3}.

On a finer scale, changes in the River gradient between the Confluence and the Woods Pond Headwaters are also evident as shown on Figure 2-10. This plot illustrates average bed elevation at the various EPA transect locations. These data suggest that within Reach 5, three distinct regions exist with respect to the River gradient: 1) a relatively steep gradient of 8.8×10^{-4} (4.6 feet per mile) upstream of RM 134 (Holmes Road Bridge); 2) a moderate gradient of 3.7×10^{-4} (2.0 feet per mile) between RM 134 and 129 (New Lenox Road Bridge); and 3) a relatively low gradient of 1.1×10^{-4} (0.6 feet per mile) downstream of RM 129. The eight-fold decrease in river gradient from the upstream portion of the study area to the Woods Pond Headwaters has a significant impact on hydrodynamics and transport processes. Spatial changes in current velocity and bed properties are related to the spatial variation in River gradient. In addition, the extent of meandering is affected by River gradient. As the gradient decreases between the Confluence and the Woods Pond Headwaters, meandering tends to increase, which is consistent with observed behavior in similar river systems (Leopold et al., 1964; Rosgen, 1996).

2.2.2.4 Sediment Depositional Areas

Sediment reconnaissance/probing activities conducted between the Confluence and Woods Pond (Reaches 5 to 6), as well as in Woods Pond (Reach 6) and Rising Pond (Reach 8), have provided information on sediment accumulation/deposition in these areas of the River. In October 1994, on behalf of GE, BBL performed reconnaissance/probing activities within Reach 5 and the upstream portion of Reach 6 as part of the MCP Phase II investigation/RFI, and documented the results in the 1996 RFI Report (BBL, 1996). CR performed sub-bottom profiling and bathymetric surveys at Woods Pond and Rising Pond in November/December 1998, in support of EPA's SI. Results of this work were documented in a report titled *Housatonic River Supplemental Investigation Sub-Bottom Profiling Woods and Rising Ponds* (CR, 1998). Based on the results of these studies, a description of sediment depositional areas and sediment thickness for each reach and subreach is provided below.

<u>Reaches 5 to 6</u>

BBL identified the following types of depositional environments in Reach 5 and the upstream portion of Reach 6:

- Channel – channel deposits typically occur in parts of the riverbed that are permanently inundated during low to moderate flow conditions;
- Terrace – terrace deposits occur in parts of the riverbed that are usually inundated during high-flow conditions, but are exposed during low-to-moderate flows;
- Aggrading bar – aggrading bar deposits, or small islands or mounds, are typically composed of coarse-grained material (i.e., sands and gravels) and usually occur along the convex sides of channel curves; and
- Backwater areas – backwater areas are quiescent areas adjacent to the main river channel that maintain a hydraulic connection to the River channel.

The results of this reconnaissance/probing effort, performed to characterize the physical depth of sediments only, are summarized in Table 2-2, below.

Table 2-2. Summary of BBL Sediment Reconnaissance/Probing Efforts — Confluence to Woods Pond

	Channel Deposits		Terrace Deposits		Aggrading Bar Deposits		Backwater Areas		Overall	
Reach	**No.**	**Sediment Depth Range (Avg) (ft)**	**No.**	**Sediment Depth Range (Avg) (ft)**	**No.**	**Sediment Depth Range (Avg) (ft)**	**No.**	**Sediment Depth Range (Avg) (ft)**	**No.**	**Sediment Depth Range (Avg) (ft)**
5A[1]	18	3.0 - 9.0 (5.7)	38	2.0 - 9.0 (5.5)[2]	3	1.5 - 6.0 (4.5)[2]	1	13 (13)	60	1.5 - 13 (5.6)
5B	10	2.0 - 11 (7.4)	5	8.0 - 14 (10.3)	0	--	3	10.5 - 12.3 (11.1)	18	2.0 - 14 (8.8)
5C and backwaters	14	2.5 - 13 (7.0)	0	--	0	--	37	0.5+ - 16.5 (6.9)	51	0.5+ - 16.5 (6.9)
6 (upstream portion only)	1	3.6+	0	--	0	--	0	--	1	3.6+
Overall	43	2.0 - 13 (6.5)	43	2.0 - 14 (6.0)	3	1.5 - 6.0 (4.5)	41	0.5 - 16.5 (7.3)	130	0.5+ - 16.5 (6.6)

Notes:
1. One additional depositional area was noted in Reach 5A, and was described as a low-lying area at an oxbow with a measured sediment depth of approximately 7 feet.
2. Range and average based on average sediment depth for some deposit(s).

Overall, this reconnaissance/probing effort identified approximately 130 sediment deposits in the reach between the Confluence and Woods Pond, with the approximate sediment depths ranging from less than 1 foot to approximately 16 feet and with an average depth of approximately 6.6 feet. In general, just over half of the 60 sediment deposits identified in the uppermost subreach (Reach 5A, between the Confluence and the Pittsfield WWTP) were characterized as terrace deposits. Reach 5A was the only subreach between the Confluence and Woods Pond within which aggrading bar deposits were identified. The overall depths of the sediment deposits (as measured to refusal) within this subreach ranged from approximately 1.5 feet to 13 feet, with an average depth of approximately 5.6 feet. Between the Pittsfield WWTP and Roaring Brook (Reach 5B), 10 of the 18 sediment deposits identified were characterized as channel deposits, while the remainder were characterized as terrace (five) and backwater area deposits (three). The depths of all identified sediment deposits within Reach 5B were shown to range from approximately 2 feet to 14 feet, with an average depth of approximately 9 feet. Within Reach 5C and its adjacent backwaters, the majority of the 51 sediment deposits identified were characterized as backwater area deposits. The remaining deposits were characterized as channel deposits. The depths of the sediment deposits within Reach 5C were shown to range from less than 1 foot to approximately 16 feet, with an average depth of approximately 7 feet. Probing within the channel of the River just upstream of Woods Pond (Reach 6) indicated the presence of one channel deposit.

Reaches 6 and 8

Based on the work performed by CR, sediment thickness in Woods Pond ranged from 16 feet in a deep hole in the southeastern corner of the pond to areas of little accumulated sediment in the outflow above the spillway. Sediment thickness in Rising Pond was reported to range from 1 foot to 8 feet. CR noted that the accumulation of sediment in Rising Pond is very heterogeneous and does not always follow the bathymetric contours (CR, 1998). Sediment thickness for Woods Pond and Rising Pond are shown on Figures 2-11 and 2-12, respectively.

2.2.3 Backwaters

The majority of backwater areas, defined as quiescent areas adjacent and hydraulically connected to the main channel of the Housatonic River, lie within the lower half of Reach 5 of the Rest of River, between New Lenox Road and the headwaters of Woods Pond, as shown on Figure 2-3. This reach of the River (i.e., 5C) is dominated by a broad wetland floodplain, which ranges from 800 feet to 3,000 feet wide, and includes the numerous backwater areas, as well as side channels and meanders (Weston, 2000). The backwater areas along this reach of the River generally range from 3 feet to 5 feet in depth and cover a total area of approximately 80 acres. Widths of the backwaters vary from approximately 10 feet to 950 feet. The bed elevations along the section of the River where the backwaters are predominant generally range from approximately 948 feet NGVD at the upper end of the reach to approximately 940 feet NGVD at the lower end. The channel gradient increases significantly below Woods Pond, and fewer backwater areas are present in the stretch between Woods Pond and Great Barrington. The section of the River that stretches from the Great Barrington gaging station to just into Connecticut (Reach 9) flows along a relatively flat floodplain that includes many meanders and oxbows, as well as some backwater areas.

2.2.4 Dams and Impoundments

2.2.4.1 Massachusetts

Five dams of varying size are currently in place, impounding water on the Rest of River in Massachusetts between the Confluence and the Connecticut border. A number of previously existing structures have been removed. Of the remaining dams, the two of primary significance are Woods Pond Dam and Rising Pond Dam. Each of these two dams is briefly described below.

Woods Pond Dam is located approximately 12 miles downstream from the GE Pittsfield facility near the towns of Lee and Lenox and forms the first dammed impoundment downstream of the GE Pittsfield facility. The original dam was constructed in 1864 to convey flow to a small mill pond, which served as a fore bay for a hydro-powered mill that has since been retired (Harza, 2001a). The existing dam at Woods Pond, a concrete overflow weir dam located approximately 200 feet downstream of the original dam, was constructed in 1989 to replace the original structure. The existing Woods Pond Dam consists of a 140-foot-long concrete overflow spillway, a concrete non-overflow gravity section with sloped downstream face at the west abutment, and a concrete and steel sheetpile raceway closure structure at the east abutment. All the dam structures are founded in bedrock. The dam has a maximum height of approximately 14 feet. The ogee spillway has a crest elevation of 948.3 feet NGVD, and the top elevation of the west abutment is 954.0 feet NGVD (Harza, 2001a).

Rising Pond, located in the Risingdale section of Great Barrington, Massachusetts and upstream from the Great Barrington USGS gaging station, is the last dammed impoundment on the Housatonic River in Massachusetts. It is located approximately 18.4 miles downstream of Woods Pond Dam. Rising Pond Dam has an associated surface drainage area of approximately 279.2 square miles and a storage volume of 712 acre-feet at the spillway crest (Harza, 1991). Rising Pond Dam has a low embankment section on the left abutment, an intake structure, a rock-filled timber crib overflow structure forming the main dam and spillway, and a wide earth embankment dam on the right abutment (Harza, 2001b). The main spillway, elevation 716.7 NGVD, is 127 feet long and 29.8 feet high. The top right headwall is at elevation 726.2 feet and the top left headwall is at elevation 725.3 feet. At its lowest elevation, the headwall provides 8.6 feet of freeboard for the spillway at normal pool (Harza, 2001b). The original Rising Pond Dam was constructed in 1900 for hydroelectric power. Major renovations to the original structure, which included an increase in the spillway elevation, occurred in 1934. In 1979, the United States Army Corps of Engineers (USACE) reported structural deficiencies in the spillway and associated dam embankments (Harza, 1991). As a result, additional construction activities were performed in 1993 to comply with the Commonwealth of Massachusetts criteria for structural stability and spillway capacity (Harza, 2001b). The renovated dam has been modified through construction to withstand a 100-year flood event. As part of the rehabilitation, the left embankment was raised to a minimum elevation of 727 feet.

GE performed additional work at Woods Pond Dam and Rising Pond Dam in 2001 and 2002 to comply with Paragraph 123.a of the CD. This work began with assessments, conducted by Harza Engineering on GE's behalf, of the structural integrity of both dams. These assessments found both dams to be structurally sound and recommended some minor maintenance and improvements (Harza, 2001a,b). GE subsequently performed these maintenance and improvement activities, which included repairing concrete, placement of rip-rap, removal of obstructions from the River channel, and raceway embankment modifications. Additional structural integrity assessments of both of these dams were performed for GE in late 2002. These assessments confirmed that the dams continue to be structurally sound, and recommended a few additional minor maintenance and repair items.

In addition to Woods Pond Dam and Rising Pond Dam, three dams of lesser significance are also located along the Housatonic River in Massachusetts between the Confluence and the Connecticut border: Columbia Mill Dam, Willow Mill Dam, and Glendale Dam. A description of these dams, together with a review of the available information on their stability and safety, is provided in 1991 and 1994 reports by Harza entitled *Report on Six Housatonic River Dams* (Harza, 1991) and *Inventory of Stability and Safety of Dams Along the Housatonic River* (Harza, 1994).

Figure 2-1 shows the locations of all five dams and impoundments in Massachusetts. Impoundment characteristics of the dams are summarized in Table 2-3.

2.2.4.2 Connecticut

The Falls Village impoundment in Falls Village, Connecticut, is the first dammed impoundment south of the Connecticut border. The dam was constructed in 1914 to provide hydroelectric power for the Hartford Electric Light Company (Frink et al., 1982). Downstream from Falls Village, the Housatonic River flows freely for approximately 20 miles to Kent, Connecticut. In Kent, the River flows through the Bulls Bridge Impoundment, which was constructed in 1903 to provide hydroelectric power for the Connecticut Light and Power Company (CL&P) (Frink et al., 1982). Both the Falls Village and Bulls Bridge Impoundments currently provide hydroelectric power to CL&P.

Downstream from New Milford, Connecticut, the Housatonic River is regulated by a series of dams that form three large impoundments. The first impoundment is Lake Lillinonah, which was formed by the construction of the Shepaug Dam in 1955 by CL&P to provide hydroelectric power. Lake Lillinonah measures approximately 1,900 acres, is 100 feet deep, and is used for recreational activities. Lake Zoar, the second large impoundment, was formed in 1919 following construction of the Stevenson Dam in Stevenson, Connecticut. Like the Shepaug Dam, the Stevenson Dam provides hydroelectric power to CL&P. Lake Zoar covers approximately 975 acres, with a maximum depth of 75 feet, and is also used for recreational activities (Frink et al., 1982). The final impoundment on the River is Lake Housatonic, formed by construction of the Derby Dam in 1870 by the Housatonic Water Company to provide hydroelectric power. Currently, the hydroelectric facility and Derby Dam are operated by Northeast Utilities. Lake Housatonic has a surface area of approximately 328 acres, a maximum depth of 26 feet, and is used for recreational activities (Frink et al., 1982).

Dam and impoundment locations in Connecticut are shown on Figure 2-2, and a summary of the characteristics of the impoundments is provided in Table 2-3.

2.2.5 Floodplain

As defined in the CD, the Rest of River includes portions of the River's floodplain. (For informational purposes, the 100-year floodplain is shown on Figures 2-1 and 2-2.) Between the Confluence and Woods Pond Dam, the Rest of River floodplain is defined as the area extending laterally to the 1 mg/kg PCB isopleth. The 10-year floodplain in this stretch and the 1 mg/kg PCB isopleth are shown on Figure 2-3. As shown on Figures 2-1 and 2-3, the bed of the railroad line that runs north from Woods Pond forms a berm, limiting the western extent of the 1 mg/kg PCB isopleth along an approximately 2.5-mile reach of the River. The floodplain extends beyond the railroad bed due to the presence of several bridges and culverts along this reach that allow water to flow past the bed during flood conditions. Downstream of Woods Pond Dam, the Rest of River floodplain encompasses those floodplain areas containing PCBs.

The floodplain of the River is relatively narrow adjacent to the GE facility in Pittsfield, Massachusetts and begins to widen in the southern portions of Pittsfield near Pomeroy Avenue and the Confluence. Between Pomeroy Avenue and New Lenox Road, the floodplain widens significantly to follow the gentle slope of the local topography. South of New Lenox Road to Woods Pond Dam, the floodplain widens slightly again. Approximately 1/2 mile south of New Lenox Road, the floodplain along the east bank of the River is confined by October Mountain, while the west bank of the River has a relatively flat topography resulting in an extended floodplain. The floodplain between Woods Pond Dam and Rising Pond Dam is relatively wide, similar to that found between Pomeroy Avenue and New Lenox Road. South of Rising Pond to the Connecticut border, an extended floodplain is evident as a result of relatively flat topography. This type of floodplain continues south through Connecticut where it narrows as the River runs through hilly terrain until it widens again as it enters the tidal estuary in Stratford and Milford.

In the stretch between the Confluence and Woods Pond, evidence of River meandering in the past is indicated by the occurrence of oxbows and abandoned cutoffs in the floodplain. Backwaters of various sizes are located in the floodplain, with the size and number of backwaters generally increasing near the Woods Pond Headwaters (~RM 125).

The area and total width of the floodplain (i.e., 1 mg/kg PCB isopleth) in Reaches 5A, 5B, and 5C are listed in Table 2-4 (below). Floodplain topography is presented on Figure 2-13.

Table 2-4. Floodplain and Backwater Geometry

Reach	Backwater Area (acres)	Floodplain Area (acres)	Minimum Floodplain Width (ft)	Maximum Floodplain Width (ft)
5A	28	325	100	2,480
5B	20	146	110	2,060
5C	79	255	1,050	2,220

Note:

Backwater areas consist of backwaters, ponds, and tributaries.

Vegetation in the floodplain varies from short grasses to mature trees. Classification of floodplain vegetation results in eight primary categories of vegetation type: palustrine, emergent (PEM); palustrine, forested (PFO); palustrine, scrub-shrub (PSS); palustrine, forested/emergent (PFO/EM); palustrine, forested/scrub-shrub (PFO/SS); palustrine, scrub-shrub/emergent (PSS/EM); upland; and wet meadow. A survey of the distribution of floodplain vegetation was conducted by TechLaw on behalf of EPA in 1998 (TechLaw, 1998). The resulting vegetation distribution is shown on Figure 2-14. The areas and relative area of each vegetation type are listed in Table 2-5 (below). The forested and scrub-shrub classes cover 72% of the floodplain.

Table 2-5. Vegetation Coverage Between the Confluence and Woods Pond Dam

Vegetation Type	Total Area (acres)	Percent Area in Floodplain (%)
Palustrine, emergent (PEM)	112	11
Palustrine, forested (PFO)	409	40
Palustrine, scrub-shrub (PSS)	173	17
Palustrine, forested/emergent (PFO/EM)	33	3
Palustrine, forested/scrub-shrub (PFO/SS)	159	15
Palustrine, scrub-shrub/emergent (PSS/EM)	89	9
Upland	23	2
Wet meadow	33	3

On many rivers, bank-full flow has a recurrence interval in the range of 1 to 2 years (Leopold et al., 1964). Applying this approximation to the Housatonic River between the Confluence and Woods Pond Headwaters suggests that bank-full flow occurs for flows ranging from about 1,150 cfs to 2,290 cfs (or 520 cfs to 1,020 cfs at Coltsville). Thus, portions of the floodplain will be inundated during floods that exceed this flow range. An example of floodplain inundation is provided by aerial photographs taken during a flood in August 1990. Figure 2-15 displays an aerial photograph taken in the vicinity of New

Lenox Road during this event. The peak flow was 3,850 cfs at Coltsville on August 7, 1990 (daily average flow of 2,010 cfs). This peak flow rate corresponds to a recurrence interval of approximately 35 years. Using drainage area proration, flood estimates for August 7 at the Confluence are 8,600 cfs and 4,500 cfs for peak and daily average flow rates, respectively. The aerial photographs were taken on August 8, which was the day after the peak flow and the daily average flow rate at Coltsville had decreased by about a factor of four (555 cfs). Even though the flood had started to recede, extensive inundation of the floodplain is evident in an aerial photograph of the New Lenox Road area (Figure 2-15).

2.2.6 Land Use

Land use within the Housatonic River Basin in Massachusetts is, in general, typical of rural areas in the northeastern United States. Multi-Resolution Land Characterization (MRLC) data were used to specify land uses in the watershed upstream of Great Barrington. The MRLC land-use data, which have a resolution of 30 meters, were compiled in the early 1990s, and are defined by 21 land-use categories. The 21 MRLC land-use categories were grouped into four general categories of land use in the Housatonic River Basin: agricultural, forested, urban, and wetlands. The forested land-use category consists of forested and shrub land. Agricultural areas are a combination of orchards, crop land, and pasture. The urban land-use category is a grouping of all developed and barren land, as well as grassy areas in the urban sector. In addition, urban areas categories were subdivided into pervious (precipitation readily infiltrates) and impervious (precipitation does not easily infiltrate) land.

The Housatonic River watershed upstream of Great Barrington is heavily forested, with agriculture, forestry, outdoor recreation, and residential landholding comprising the principal land uses (Figure 2-16). In general, the same pattern of land use occurs in northwestern Connecticut, with increased emphasis on recreational uses and a continued general absence of significant industrialization. In the central portion of the basin, several large impoundments and state parks are used for recreation, while significant industrial areas are located in the vicinity of the Still River near Danbury, Connecticut (New England River Basins Commission [NERBC], 1980). By contrast, the lower basin, near the mouth of the Housatonic River, is heavily urbanized and industrialized (NERBC, 1980). A summary of land use along the River is presented in Table 2-6 (below). (Note that the summary presented for the Connecticut portion of the Housatonic River Basin reflects mostly forested land as the urban/industrial corridor south of Danbury is a small percentage of the total land area.)

Table 2-6. Land Use Categories of the Housatonic River Basin

Reach	Percent Area				
	Urban	Agricultural	Forested	Wetlands	Other
Confluence to Woods Pond Dam[1]	13	7	68	9	3
Woods Pond Dam to Great Barrington[1]	9	8	74	6	3
Great Barrington to MA/CT Border[2]	7	21	68	3	1
MA/CT Border to Long Island Sound[2]	13	19	64	1	3

Notes:
1. Confluence to Great Barrington: MRLC Land Use Coverage (30 meter resolution); early 1990s.
2. Great Barrington to Long Island Sound: GIRAS Land Use Coverage (1:250000); mid 1970s to early 1980s.

2.3 Regional Climatic Conditions

The upper Housatonic River Basin in Massachusetts is generally characterized by a temperate climate with warm, humid summers and cold winters. Annual precipitation in the form of rain and snowfall averages approximately 46 inches per year, distributed fairly evenly from month to month. Prevailing winds are from the west. The mean annual temperature reported at the Pittsfield airport is approximately 46^o Fahrenheit (F), while the mean summer and winter temperatures are 68^{o}F and 28^{o}F, respectively. The upper basin experiences an average growing season of 120 days (NERBC, 1980).

The climate of the lower basin in Connecticut is characterized by milder winters and hotter summers than those found in the upper basin. Annual precipitation varies throughout the lower basin from 46 to 58 inches per year (NERBC, 1980). The mean annual temperature of the lower basin is approximately 49^{o}F, while the mean summer and winter temperatures are 71^{o}F and 31^{o}F, respectively. The lower basin experiences an average growing season of up to 180 days (NERBC, 1980). A summary of monthly and annual precipitation averages by location is presented in Tables 2-7 and 2-8. Monthly temperature averages and extremes are summarized in Table 2-9.

Several available sources of information provide varying levels of wind speed and direction data. Data were obtained from the document titled *Ambient Air Monitoring for PCB Study* (Zorex Environmental Engineers, 1992). During this study, wind speed and direction were periodically recorded at an on-site weather station located at the East Street Area 2-South site at the GE Pittsfield facility. Wind data were collected for 1 year, from August 1991 to August 1992. These data indicated that the maximum wind speed was 27.22 miles per hour and that the predominant wind direction was from the west.

A database of wind information was also developed based on data obtained from the National Climatic Data Center. The database consists of calculated minimum, maximum, and average daily wind speeds and wind directions for each month from each location, calculated from observations collected from January 1984 to October 1999. According to the database, the maximum average daily wind speed for each month ranged from 15.9 to 25.7 miles per hour at the Albany weather station, and from 15.2 to 27.9 miles per hour at the Hartford weather station. At both stations, the general wind direction was from the southwest.

2.4 Hydrology

The hydrologic characteristics of the Housatonic River have been documented in studies performed by Stewart, the Federal Emergency Management Agency (FEMA), USGS, NERBC, and CAES (Stewart, 1982; FEMA, 1981a, 1981b, 1982a, 1982b, 1982c, 1982d, and 1987; Norvitch et al., 1968; Wilson et al., 1974; NERBC, 1980; and Frink et al., 1982).

The Housatonic River system is fed primarily by runoff from rainfall and melting snow. As previously indicated, the annual precipitation in the drainage basin averages approximately 46 inches per year. Approximately 24 inches per year leave the basin as runoff through the Housatonic River, another 20 inches per year escape by evaporation and transpiration to the atmosphere, while the remaining 2 inches per year infiltrate into groundwater-bearing zones (Norvitch et al., 1968).

Manmade discharges to the Housatonic River contribute significant flow quantities. The average combined discharge from several industrial facilities located in Massachusetts amounts to approximately 26 cfs of wastewater into the River, and discharges from seven municipal treatment plants located in Massachusetts contribute an additional 22 cfs (Frink et al., 1982). Municipal/industrial discharges into the Connecticut portion of the Housatonic River amount to approximately 35 cfs (Frink et al., 1982).

2.4.1 Flow

The flow rate of the Housatonic River is monitored by USGS, which maintains a total of five flow gaging stations on the River (two in Massachusetts and three in Connecticut). The first station in Massachusetts, on the East Branch of the Housatonic River in Coltsville, is approximately 5.5 miles upstream of the Confluence and has an associated drainage area of 57.6 square miles (Bent, 1999). Hydrologic data recorded at Coltsville during the period of 1937 to 1999 indicate a mean annual flow rate of 106 cfs, which corresponds to a runoff rate of 1.81 cfs/mi^2.

The second gaging station on the Housatonic River in Massachusetts is located in Great Barrington, approximately 20 miles downstream from Woods Pond. The River drains an area of approximately 282 square miles above this point (Bent, 1999). USGS reports a mean annual flow rate at 527 cfs for the Housatonic River at Great Barrington, based on data recorded from 1914 to 1999. Despite the five-fold increase in flow between Great Barrington and Coltsville, the runoff rate of Great Barrington is 1.86 cfs/mi^{2,} which is almost identical to the runoff rate for the Coltsville gage. This result indicates that the hydrologic response of the watershed is relatively uniform on annual timescales.

The flow rate in the River is variable, with the maximum recorded value at Coltsville being 6,400 cfs in September 1938. Typical flow rates at Coltsville during low-flow periods in the summer are approximately 20 cfs. The 7-day, 10-year (i.e., 7Q10) low-flow rate is 12 cfs at Coltsville. Variability in the Coltsville hydrograph is illustrated on Figure 2-17, which presents daily average flow rates from 1980 to 2000.

Annual maximum daily-average flow rates at Coltsville varied from 580 cfs to 2,860 cfs between 1980 and 2000. The maximum annual floods range from about five to 60 times greater than the mean flow rate at Coltsville. The relatively high variability in flood flow rate for the Housatonic River in the study area is typical of the headwater region of a river; variability in the range of flow rate tends to decrease as drainage area increases.

Flood frequency analyses were conducted using annual instantaneous peak flow rates measured by USGS at the Coltsville and Great Barrington gaging stations. The analyses were conducted based on the Log Pearson Type III distribution (e.g., Bedient and Huber, 1992). The results are summarized in Table 2-10 (below). Since 1980 at Coltsville, twelve 2- to 5-year floods, five 5- to 10-year floods, and four 10- to 25-year floods have occurred.

Table 2-10. Flood Frequencies at Coltsville and Great Barrington

Flood Return Period (years)	Flow Rate at Coltsville (cfs)	Flow Rate at Great Barrington (cfs)
1	520	1,710
1.5	840	3,150
2	1,020	3,720
5	1,360	5,340
10	1,710	6,570
25	2,770	8,320
50	5,810	9,770
100	6,920	11,350

The three USGS flow gaging stations on the Housatonic River in Connecticut include one at Falls Village near the Massachusetts state line, one at Gaylordsville, and one at Stevenson. The mean annual flow rate at the Falls Village station is reported as 1,092 cfs during the period of 1913 to 1999, with an associated drainage area of 634 mi^2 (USGS, 2002).

The Gaylordsville station is located in Litchfield Connecticut, approximately 30 miles downstream of the Massachusetts state line. The River drains an area of approximately 996 mi^2 above this point (USGS, 2002). The mean annual flow rate at the Gaylordsville station is reported as 1,692 cfs during the period of 1941 to 1999.

The Stevenson station is located at the Stevenson Dam, which serves to impound Lake Zoar. The mean annual flow rate past the dam is reported as 2,646 cfs based on 71 years of record. The Stevenson gaging station has an associated drainage area of 1,544 mi^2 (USGS, 2002).

Variations in water surface elevation (i.e., stage height) with flow rate have been measured at different locations in the River and its tributaries. Of particular interest are the EPA data collected during a number of sampling events between 1998 and 2001, which were used to construct rating curves at four locations: Pomeroy Avenue Bridge, Holmes Road Bridge, New Lenox Road Bridge, and Woods Pond Footbridge. These rating curves are shown on Figure 2-18 and describe the stage-flow relationship at various points in the system. The limited data at Holmes Road Bridge make it difficult to determine any significant details (e.g., bank-full flow rate) at that location. Stage height at Woods Pond Footbridge tends to increase linearly with increasing flow rate; lack of significant discontinuities in stage height suggests that over-bank flow effects are minimal at this location. At New Lenox Road Bridge, the relationship between stage height and discharge is not as continuous as it is at Woods Pond Footbridge. Stage height data collected at flow rates greater than 1,000 cfs appear to increase relatively slowly as flow rate increases, indicating that bank-full occurs at approximately 1,000 cfs in the vicinity of New Lenox Road. The stage height-flow rate relationship at the Pomeroy Avenue Bridge is approximately linear below 1,000 cfs. At flow rates above 1,000 cfs, the data suggest that stage height increases slowly with increasing discharge, indicating that bank-full flow occurs at about 1,000 cfs.

To provide an indication of River flow variability, Table 2-11 (below) includes the average daily flow, the 90th percentile, 99th percentile, and maximum observed daily average flows for the USGS gage at Coltsville. The 90th and 99th percentile flows represent the daily average flows which have been exceeded 10% and 1% of the time, respectively, for a particular month, based on the period of record through September 30, 1997. For example, in the month of June, the long-term daily average flow is 56 cfs. However, on 10% of days in June, the daily average flow is expected to exceed 159 cfs, and 1% of the time it will exceed 609 cfs. The maximum daily average flow provides the upper bound of flow conditions for that month observed over the period of record through September 30, 1997.

Table 2-11. Daily Average Flows in the Housatonic River by Month[1]

	Average (cfs)	90 Percentile (cfs)	99 Percentile (cfs)	Maximum (cfs)
January	69	177	736	1820
February	73	191	503	1190
March	124	366	1060	4460
April	204	522	1220	2860
May	106	281	632	2750
June	56	159	609	1600
July	37	93	400	1500
August	33	84	337	2010
September	36	851	418	3110
October	50	133	526	1800
November	70	196	577	1900
December	75	191	567	4350

Note:
1. Flows based on time period from March 8, 1936 to September 30, 1997.

2.4.2 Velocity

EPA collected velocity data at three locations on the main stem of the River during the May 1999 flood: Pomeroy Avenue Bridge, New Lenox Road Bridge, and Woods Pond Footbridge. Current velocities were also measured near the mouths of three tributaries during this flood: West Branch, Sackett Brook, and Roaring Brook. Along the main stem of the River, maximum velocities at the peak of the flood ranged from 2 feet per second (ft/s) at New Lenox Road Bridge to about 5 ft/s at the Pomeroy Avenue Bridge. Minimum velocities at these two locations were less than 1 ft/s to 2 ft/s. Velocities in Sackett Brook ranged from 1 ft/s to 3 ft/s, while peak velocities in Roaring Brook were about 6 ft/s.

EPA obtained additional velocity data over a range of flow rates between 1998 and 2001. These data were used to construct velocity rating curves at four locations: Pomeroy Avenue Bridge, Holmes Road Bridge, New Lenox Road Bridge, and Woods Pond Footbridge. Cross-sectional average velocity as a function of flow rate at these four sites is presented on Figure 2-19. Generally, velocity increases approximately linearly with increasing flow rate at all four locations. Velocity at the local mean flow rate (shown as a vertical dashed line on the rating curve plots) varies among the different locations, ranging from 1.1 ft/s to 1.4 ft/s at Pomeroy Avenue and Holmes Road Bridges to 0.6 ft/s at New Lenox Road Bridge to about 0.25 ft/s at Woods Pond Footbridge. Generally, cross-sectional average velocity tends to decrease as one travels from the Confluence to Woods Pond. This spatial trend in velocity is consistent with the spatial trend in River gradient (Section 2.2.2.3 and Figure 2-10). The highest velocities are observed in the region with the highest River gradient and velocity decreases as the River gradient decreases, which is consistent with observed behavior on many other rivers (Leopold et al., 1964).

2.5 Hydrogeology

The hydrogeology of the Housatonic River Basin has been described in detail as part of several prior reports (Norvitch et al., 1968; Wilson et. al, 1974; NEBRC, 1980; EHC Corporation, 1991; and Harza, 1988) and was previously summarized in Section 2.5 of the 1996 RFI Report (BBL, 1996).

In general, the overburden material of the Housatonic River Basin has been identified chiefly as sedimentary rock, including mainly glacial till and stratified drift. Bedrock of the Housatonic River Basin is characterized primarily as metamorphic rock, such as quartzite, gneiss, and dolomite. Groundwater varies greatly throughout the basin in terms of both quality and available quantity. In areas where crystalline rock such as gneiss and granite occur, groundwater tends to be only slightly mineralized as a result of the relative insolubility of these rock types. Aquifer yield in these areas can be abundant where bedrock contains significant fractures. However, groundwater quantities are limited where fracturing is not prevalent. In areas where schist predominates, groundwater may contain significant levels of iron and manganese, and aquifer yields may be limited even where fracturing is extensive. Groundwater is typically mineralized in locations such as the lowlands and valleys of the Housatonic River Basin where soluble limestone and dolomitic bedrock predominate. These valleys are generally covered with deep glacial deposits composed of stratified drift. Where these coarse sands and gravels exist, aquifer yields can be significant.

As a result of the abundant surface water supplies in the upper Housatonic River Basin in Massachusetts, there is no known use of subsurface aquifers along the River in Massachusetts for municipal water supply, although a limited number of wells are used for private and industrial water supply. USGS has identified several concerns regarding the suitability of groundwater in the upper Housatonic River Basin in Massachusetts for municipal water supply (Norvitch et al., 1968). The main concerns expressed by USGS involve the storage capacity and land use associated with aquifers in certain areas throughout the basin; in terms of groundwater quality, high background levels of iron and manganese may be of concern (Norvitch et al., 1968; Wilson et al., 1974). For its water supply, the City of Pittsfield utilizes five surface water reservoirs, while the Town of Lenox depends primarily on two reservoirs and purchases some of its water supply from Pittsfield (ChemRisk, 1996). Although a limited number of residences in the Town of Lenox use private wells, review of available information indicated no such wells in the floodplain (ChemRisk, 1996). In short, groundwater within the Rest of River area in Massachusetts is not currently known to be used for drinking water supply nor is it likely to be used for this purpose in the foreseeable future (ChemRisk, 1996).

Moreover, the available information, as well as regional hydrogeologic conditions, indicate that there is unlikely to be any significant impact from PCBs in the River on adjacent groundwater (ChemRisk, 1996). For example, Gay and Frimpter (1984) evaluated the possible impacts of PCBs in the sediments of Woods

Pond on adjacent groundwater. These investigators reported that PCBs from sediments in Woods Pond did not migrate into groundwater in the area despite the significant pumping of industrial water supply wells located immediately adjacent to Woods Pond. In addition, investigations at the GE Pittsfield facility areas located along the Housatonic River have identified those areas as a region of groundwater discharge to the River. In general, groundwater associated with the GE Pittsfield facility tends to be recharged by upland areas, with the Housatonic River being the final receptor of groundwater discharges. Similarly, as noted in the SI Work Plan (Weston, 2000), the Housatonic River is the predominant groundwater discharge point for the overall Rest of River area. This means that most groundwater in the Housatonic River Basin (which includes the GE Pittsfield facility) eventually discharges to the Housatonic River, either by direct subsurface flow through the River bottom sediments, or by discharging into smaller tributaries which then flow to the Housatonic River (Weston, 2000).

2.6 Primary Constituents

The primary constituents of concern in the Rest of River are PCBs. In addition to PCBs, various other chemical constituents, including SVOCs, VOCs, pesticides, herbicides, PCDDs/PCDFs, and metals, have been analyzed for in samples collected from the different media in the Rest of River area. Information on the frequency of detection and summary statistics on concentrations for these chemical constituents in surface water, sediments, floodplain/riverbank soils, and biota are presented in Appendix C. In general, these constituents have been detected at relatively low concentrations (in relation to background or screening levels) or have had relatively low frequencies of detection. EPA has advised GE that, based on its human health and ecological screening evaluations, while a limited number of these non-PCB constituents – notably, PCDDs/PCDFs -- may be carried through its human health and ecological risk assessments, PCBs should be considered the primary constituents of concern in the Rest of River and should be the focus of the data analysis in this RFI Report. As such, while all chemical data collected from the Rest of River are summarized in this RFI Report, the discussions in subsequent sections of this report, including the discussions of sources and fate and transport in Section 8, focus primarily on PCBs. However, to a lesser extent, these discussions also present summary information on PCDD/PCDF compounds, since they may be included in the risk assessments.

Section 2 Tables

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Table 2-3
Characteristics of Housatonic River Impoundments in Massachusetts and Connecticut

Dam/Impoundment	Dam Spillway Elevation	Impoundment Area (acres)	Impoundment Average Depth (ft)	Dam Freeboard (ft)	Impoundment Purpose
Woods Pond	948.3	60	3-15	--	Forebay for a hydro-powered mill[c]
Columbia Mill	907.8[a]	28[b]	3[e]	4.5[b]	Not available
Willow Mill	838.4[a]	14.2[f]	4.7[e]	7[b]	Hydroelectric Power[b]
Glendale	810.9[a]	5[b]	5.3[e]	6[b]	Hydro-power[g]
Rising Pond	716.6[b]	44[b]	3.8[e]	--	No longer used[h]
Falls Village	--	13.2[f]	7.6[e]	--	Hydroelectric Power[d]
Bulls Bridge	--	132.8[f]	5.1[e]	--	Hydroelectric Power[d]
Shepaug Dam (Lake Lillinonah)	--	1900[d]	100[d]	--	Hydroelectric Power, Recreation[d]
Stevenson Dam (Lake Zoar)	--	975[d]	75[d]	--	Hydroelectric Power[d]
Derby Dam (Lake Housatonic)	--	328[d]	26[d]	--	Hydroelectric Power, Recreation[d]

Notes:
[a] Information obtained from *Inventory of Stability and Safety of Dams Along the Housatonic River* (Harza, 1994).
[b] Information obtained from *Report on Six Housatonic River Dams* (Harza, 1991).
[c] Retired, information obtained from *Woods Pond Dam, Structural Integrity Assessment* (Harza, 2001a).
[d] Information obtained from Frink et al., 1982
[e] The average depth of impoundment was calculated using average depth of each transect. Transect data taken from the "BATHYMETRY" table which is included as part of the GE Housatonic database (release February 28, 2002).
[f] Area calculated using average width and average length estimated using GIS
[g] Retired, information obtained from *Report on Six Housatonic River Dams* (Harza, 1991).
[h] Abandoned, information obtained from *Rising Paper Dam, Structural Integrity Assessment* (Harza, 2001b).
-- Information currently not available.

Table 2-7
Monthly Precipitation Averages by Location

Month	Stockbridge, MA	Great Barrington 5 SW, MA	Sheffield 3 SSW, MA	Norfolk 2 SW, CT
	1/1970 - 9/1985	12/1973 - 10/1999	1/1979 - 3/1982	1/1970 - 10/1999
January	2.6	3.9	4.2	4.2
February	3.0	2.9	4.2	3.6
March	3.5	3.6	3.6	4.6
April	3.9	3.7	4.2	4.5
May	5.4	4.7	3.9	4.8
June	4.0	3.5	2.9	4.4
July	3.9	4.1	3.2	4.7
August	4.6	4.8	3.6	4.7
September	4.0	4.3	3.2	4.5
October	3.7	4.1	4.1	4.4
November	3.7	4.1	3.5	4.7
December	3.7	3.5	2.5	4.4
Total	**46.2**	**47.4**	**43.0**	**53.4**

Notes:
1. Numbers represent total monthly precipitation in inches.
2. Source of data: National Climatic Data Center, a branch of NOAA (www.ncdc.noaa.gov).

Table 2-8
Annual Precipitation Averages by Location

Year	Stockbridge, MA	Great Barrington 5 SW, MA	Sheffield 3 SSW, MA	Norfolk 2 SW, CT
	1/1970 - 9/1985	12/1973 - 10/1999	1/1979 - 3/1982	1/1970 - 10/1999
1970	35	--	--	43
1971	39	--	--	48
1972	54	--	--	67
1973	50	--	--	60
1974	51	45	--	53
1975	54	61	--	64
1976	--	48	--	57
1977	--	57	--	65
1978	--	40	--	38
1979	51	56	54	61
1980	33	34	35	42
1981	40	42	40	46
1982	--	--	--	45
1983	--	54	--	63
1984	--	50	--	55
1985	--	37	--	47
1986	--	46	--	57
1987	--	42	--	48
1988	--	42	--	48
1989	--	51	--	57
1990	--	64	--	57
1991	--	48	--	49
1992	--	44	--	51
1993	--	47	--	49
1994	--	44	--	54
1995	--	39	--	48
1996	--	57	--	74
1997	--	35	--	47
1998	--	--	--	42
Average	**45**	**47**	**43**	**53**

Notes:
1. Numbers represent total annual precipitation in inches.
2. -- = Not Available.
3. Source of Data: National Climatic Data Center, a branch of NOAA (www.ncdc.noaa.gov).
4. Only includes years with at least 310 measurements.

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Table 2-9
Monthly Temperature Averages and Extremes

Albany County Airport							
Month	**Daily Minimum Temperature (^{0}F)**			**Daily Maximum Temperature (^{0}F)**			**Average Daily Temperature (^{0}F)**
	1/1970 - 10/1999			**1/1970 - 10/1999**			**1/1970 - 10/1999**
	Minimum	**Maximum**	**Average**	**Minimum**	**Maximum**	**Average**	
January	-28	56	13	-2	65	31	--
February	-21	50	15	4	67	34	--
March	-6	56	25	13	86	44	--
April	13	63	36	25	92	58	--
May	28	68	46	42	94	70	--
June	36	72	55	55	96	78	--
July	40	74	60	60	99	83	--
August	34	74	58	58	97	80	--
September	28	71	50	52	93	72	--
October	17	64	39	37	86	60	--
November	5	61	31	22	81	48	--
December	-20	52	20	3	71	36	--
Average	11	63	37	31	86	58	

Hartford-Bradley International Airport							
Month	**Daily Minimum Temperature (^{0}F)**			**Daily Maximum Temperature (^{0}F)**			**Average Daily Temperature (^{0}F)**
	1/1970 - 10/1999			**1/1970 - 10/1999**			**1/1970 - 10/1999**
	Minimum	**Maximum**	**Average**	**Minimum**	**Maximum**	**Average**	
January	-21	53	17	3	64	34	--
February	-13	50	20	8	73	38	--
March	1	56	28	22	87	47	--
April	9	62	38	24	96	60	--
May	28	69	48	44	99	72	--
June	37	73	57	52	98	80	--
July	46	78	63	62	101	85	--
August	39	77	61	60	101	83	--
September	30	72	52	52	99	74	--
October	17	69	41	38	86	63	--
November	1	65	33	24	81	51	--
December	-14	49	23	8	74	39	--
Average	13	64	40	33	88	61	

Note:
1. All data downloaded from www.ncdc.noaa.gov.
2. -- = Not Available.